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Task 1 (UN 672) Correlation of Satellite and Ground Data in Air Pollution Studies

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## ABSTRACT

Correlation of Satellite and Ground Data in Air Pollution Studies

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An update of image analysis is presented. The establishment of a centralized remote sensing laboratory and description of new equipment, and data handling plan are described.

I. Image Analysis

A. Review 23 September 1972, 1062, 15193

Previous work on four black and white MSS transparencies on this date revealed three large smoke plumes, three contrails, and haze. Photogrametric and densitometric techniques have been used and the data presented in previous reports.

A check on the scan speed of the NSL Recording densitometer resulted in a revised figure for the horizontal increments on Figure 4 in the progress report of 27 March. Each increment represents 230 meters rather than the previously stated 254 meters.

A color print and transparency have been received and further densitometry is scheduled for the transparency.

10 October, 1972 1079 15140

One large plume and several smaller ones were noted in previous reports. Subsequent color transparencies and prints have resulted in the following revision:

The plume described in the 30 November progress report in Section III D as the Barrets corner plume is actually a ground feature, the possibility of several plumes along the eastern branch of the Elizabeth River is still evidenced.

11 October 1972, 1080 15194

A positive color print of this image has been received. No additions to previous reports were obtained. Further analysis is scheduled.

B. New Images 3 December 1972, 1133 15144

Nine inch black and white transparencies in Bands 5, 6, and 7 have

been received. Black and white and color photographs were collected on the ground as well as meteorological and particulate data. Densitometry of the Chesapeake shoreline was conducted at Langley Air Force Base with negative results, most likely attributable to the coded format used. The wake of a vessel entering Hampton Roads is clearly evidenced on the image. Two areas indicating plumes are over the Norfolk Naval Base and over the Eastern Branch of the Elizabeth River.

We are awaiting receipt of color transparencies. Densitometry work is scheduled for this frame.

4 December 1972, 1134 15202

Nine inch black and white transparencies were received for Bands 5, 6, and 7. No indications of smoke plumes is evidenced. Further densitometry work is scheduled for this image. Color transparencies have been ordered.

9 January 1973, 1170 15200

Nine inch black and white transparencies were received for Bands 4, 5, 6, and 7. Snow is evident throughout the scene. A plume over the Vepco plant southeast of Richmond is probable. Densitometry work is scheduled for this image. Color transparencies have been ordered.

26 January 1973, 1187 15142

Nine inch black and white transparencies in 4 MSS bands, a color transparency and prints have been received. Color and black and white photography along with meteorological and particulate data were collected from the ground. No evidence of plumes or haze is apparent although a closer look at the southern and eastern branches of the Elizabeth River and of the Norfolk Naval Base is scheduled.

13 February 1973

Nine inch black and white transparencies in Bands 4 through 7 were examined. No clear evidence of plumes were noted. Densitometry over the southern branch of the Elizabeth River is scheduled.

II. Establishment of the Remote Sensing Laboratory

A. Space and Equipment

As work continued on ERTS and related projects requiring the viewing of remote imagery, it became increasingly apparent that people, equipment, and information had to be centralized. Consequently, 600 square feet was obtained from the University to be developed as a remote sensing laboratory. It is located in the Technical Institute in close proximity to the meteorological laboratory and the geomorphology laboratory. Extensive modifications were necessary to prepare the room to accomodate light and dust sensitive equipment. Work still planned includes the rennovation of ceiling and floor and modifications to the power and lighting systems.

A Wild Heerburg Stereocomparator was delivered from NASA Langley and the company representative is scheduled to assemble it this month.

An NSL Microphotometer has been installed in the lab and work is underway to rectify the output signal for use with a chart recorder.

A PDP-5 Computer is in the room and will eventually be used in conjunction with the microphotometer.

A Richardson Viewer with 5X, 15X and 30X enlargement capability is in the lab and will facilitate interpretation of aerial as well as satellite imagery. It will also enhance graphic production capabilities.

Further, the laboratory will include two light tables, chart boards,

USE SLIP

This image was analyzed for: _____

_____

_____

Using the following equipment: _____

_____

☐☐☐ Use Code

The quality of the image is sufficiently good for it to be used in oral or written presentations. Yes _____ No _____

This image was analyzed by: (Person) _____

For: (Project) _____

☐☐☐ User Code

Name: _____

Todays Date: _____

Figure 1. *Use slip.*

and chart files, film files, desks for users, microfiche viewers and a microfiche library.

B. Data Handling

As the amount of data entering the lab and generated in the lab increases, the necessity of a data handling plan becomes apparent.

A new image that enters the laboratory will be catalogued under Columns Fileode, Date, Geocoordinates, and Descriptive location. This information will be recorded on a standard coding sheet and the picture will be filed. Periodically (once a week) the code sheets will be taken for key punching. A card will be punched and four duplicates made. These will be filed under:

1. File code
2. Date
3. Geocoordinates
4. Descriptive location.
5. Image Type

The image will be given quick scan before filing and its access number will be noted with a recommendation to any regular user who may be interested. Each week the small number of regular users will find a list of images by access number that may be of interest to them. Regular users will specify what their interest may be.

Each time a user successfully uses an image and returns it to the file he will fill out a user slip (Figure 1) listing his name or project code number and the use to which he put the photo listed by use code number. He will specify whether the image is good enough for him to use for a written or oral presentation.

A column by column breakdown of the code sheet follows (also see Figure 2).

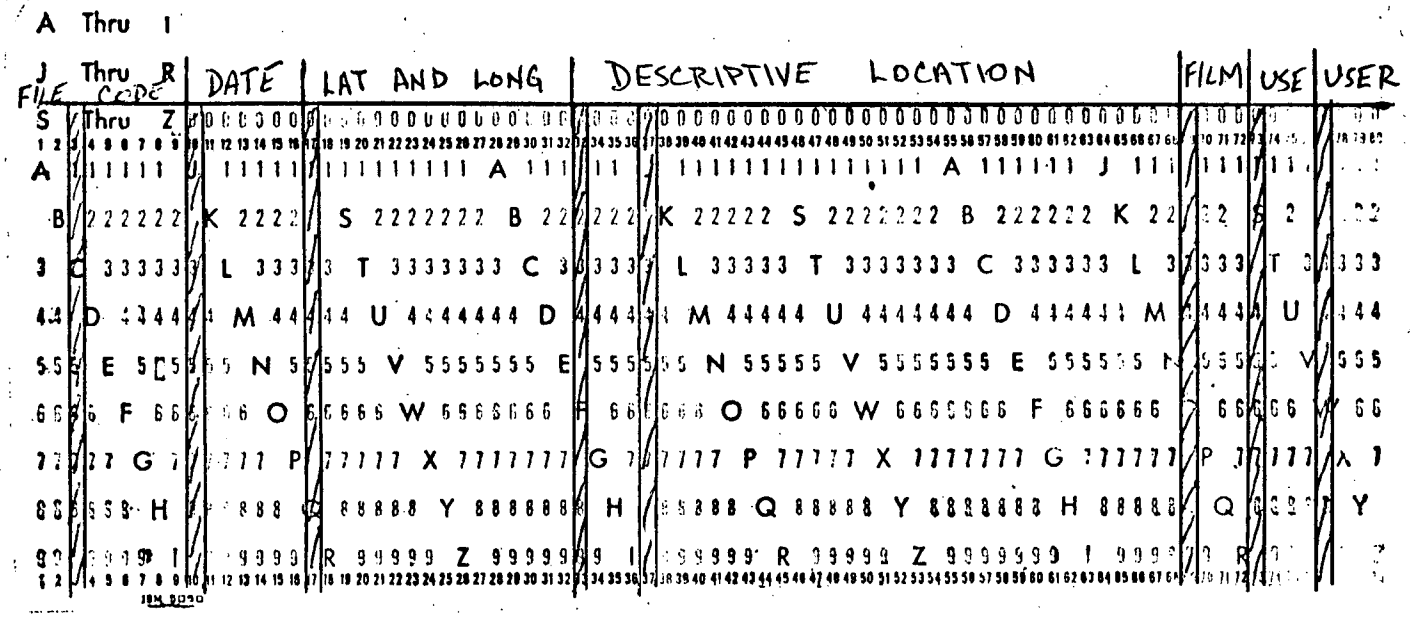


Figure 2. *Code sheet.*

File - Columns 1 and 2 (End punching column two)

Code number descriptive of the project from which the photo or image came (e.g. 01 for ERTS A, 02 for ERTS B, Task 1, 11 for Wallops, etc.). Type written list of code numbers posted in lab. These columns define ownership of the image.

Access No. - Columns 4 - 9 (End punching column nine)

Images will be filed under an access number in file drawers for flat images, or on reels for spools of film. The access number will be a sequential number assigned by the lab, to be used in conjunction with file number. File and access number together will be referred to a file code.

Date - Columns 11 - 16 (Begin punching in column 11)

A six-digit number specifying the date of the photo by increasing time unit (i.e. day, month, year). For example:

23 January 1974--------230174
3 October 1973--------031073

Geocoordinates - Columns 18 - 32

Latitude - Columns 18 - 24

Column 24 - N or S for north or south

Column 18 - Begin punching latitude in degrees, minutes and seconds sequentially (e.g. N 37° 42'8" is 374208N, W 6° 9'23" is 0060923W)

Longitude - Columns 25 - 32

Column 32 - E or W for east or west

Column 25 - Begin punching longitude in degrees, minutes and seconds sequentially recording degrees as a three digit number (e.g. 72° 16'5" is 0721605, 112° 3'58" is 1120359).

Latitude and longitude will refer to the center point of the image.

Descriptive location - Columns 36 - 67

Code - Columns 34 - 36

A code number of 1 to 3 digits denoting in nautical miles the ground distance from center of photo to outside edge. This shock in conjunction with Geocoordinates and description of location will permit an idea of scale when searching by coordinates or some other proximate method.

Name - Columns 38 - 68

A descriptive wording of the subject of the picture abbreviated to 30 symbols. (e.g. Vepco-Chester; Lynnhaven-spartina).

Film Type - Columns 69 - 72

These columns shall be coded as follows:

| Column 70 | | Column 71 | | Column 72 | |
|---|---|---|---|---|---|
| | Format | | Image Type | | Subject Type |
| 0 | 35mm Trans. | 0 | B&W Panchro | 0 | Vertical Pos |
| 1 | 70mm Trans | 1 | B&W Blue | 1 | Oblique Pos |
| 2 | 9½"x9½" Trans | 2 | B&W Green | 2 | Panor. Pos |
| 3 | 6" Trans | 3 | B&W Red | 3 | Vertical Neg |
| 4 | Other Trans size | 4 | B&W Near I-R | 4 | Oblique Neg |
| 5 | 35mm Print | 5 | B&W Far I-R | 5 | Panor. Neg |
| 6 | 70mm Print | 6 | B&W or color polarized | 6 | Briefing graphic |
| 7 | 9½"x9½" Print | 7 | True color | 7 | Ground truth |
| 8 | Other Print size | 8 | I-R False color | 8 | Map |
| 9 | Not applicable | 9 | Other | 9 | Other |

Trans = Transparency

The image type can be classified into one of these categories for each of the three columns.

Use Code - Columns 74 - 76

A 3 digit number from a master code list which can be easily added to, describing the use the photo has been put to. (e.g. one number for smoke plume studies, one number for contrast reduction, one for biological zonation, etc.). This file will help us quickly locate photos useful for specific purposes. If the first digit of the five digit number is a 9, the photo is good enough for use in oral presentations or published documents. (e.g. 00010 = smoke plume densitometer, 90010 = smoke plume densitometer, exceptional image. Each time an image is pulled for a new use, the user will file a user form, a new-use card will be duplicated so that the same image may be filed under several different use-user location.)

User Code - Columns 78 - 80

A three digit number assigned to each person, or project that uses

an image. This code will:

a) help him relocate interesting images he has previously seen,

b) help us keep a record of who is using the lab, and how much.

(For Data Flow Diagram see Figure 3)

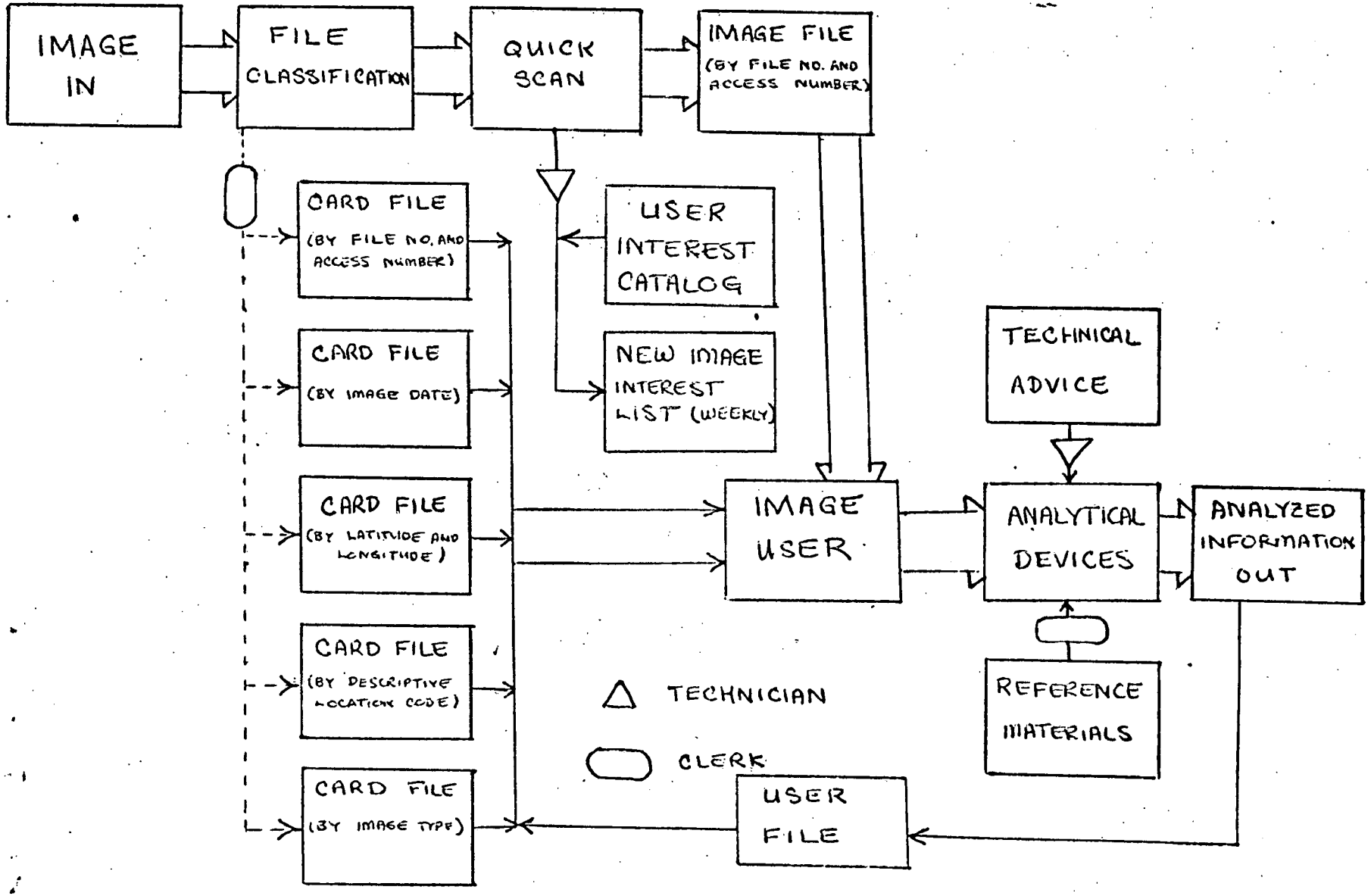


Figure 3. *Data flow diagram.*

The status of the project can be summarized as follows:

(a) With equipment centralized and assembled, we can begin a systematic analysis of imagery utilizing the recording microphotometer and the Wilde Stereocomparator. A cross differencing technique with PM tubes focused on equivalent points in different bands will be explored, with the Wilde (Re: ERTS B Proposal of 20 January, 1973).

(b) Implementation of the data handling plan.

(c) Arrangements have been made with the VAPCB to acquire meteorological and particulate data in a reduced form.

(d) The Meteorological lab at the University will be expanded to include a LARS Terminal.

(e) The monitoring van is in the final stages of completion and will be in the field next month. This will add considerable dimension to our ground data collection capabilities.